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ABSTRACT

Student library assistants and undergraduate and graduate students from agricultural and biological engineering, biological sciences, and entomology participated in a study to determine the effectiveness of instructional materials adapted to specific science disciplines for developing practical skills in the use of library resources. All students participating in the study completed a core section of workbook chapters and assignments covering basic library research tools in the sciences, while specific instruction by subject area and discipline was provided in the index and abstract chapters of the various workbooks. A group of students in biological sciences who served as a control group did not use workbooks. All students took a pretest and identical posttest as a measure of their capability in usage of library materials. Results of the study showed that students completing the workbook had significantly greater score increases on the standard test than those to whom the workbook was not available. Workbook content, timetables for assignment completion, assignment correction, workbook editing and printing, project cost, and library staff involvement are discussed. A two-phase program of science-related library instruction is outlined. Four tables, two figures, and three references are provided with workbook tables of contents and student test scores appended. (Author/ESR)

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FEASIBILITY STUDY: Library Instruction in Specific Science Disciplines Using the Self-Paced Workbook Adapted to Departmental Needs, Mitchell Memorial Library, Fall 1981.

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II. BACKGROUND

A. Pilot Study - Fall 1980

Science Resources: A Self-Paced Instructional Workbook[1] was developed to answer a widely-perceived need of students, especially in the sciences, to develop practical skills in the effective use of library resources. A pilot study was carried out in the fall, 1980, by Dwayne Wise, Department of Biological Sciences, and Susan Ellsbury, Mitchell Memorial Library, with introductory botany students, library aides, and selected other students. One group of students were assigned (or volunteered) to complete the workbook, and a limited number requested to use the workbook in order to complete their library assignments. A control group were given similar library assignments, but did not have access to the workbook. Both sets received pre-tests and post-tests. Post-test scores of the students in the first set were statistically higher than those of the control group indicating the beneficial learning effects for those who utilized the workbook instruction.[2]

B. Feasibility Study - Fall 1981

The workbook[1] was modified and expanded to provide library instruction in specific subject disciplines. Students from three departments (Agricultural and Biological Engineering, the Department of Biological Sciences, and the Department of Entomology) participated as a part of a regular departmental course. Because of the number of students involved, especially from Biological Sciences, and the number of workbooks available at the current level of funding, a number of students served as a control group. All students received library assignments typical of those assigned in the Fall of 1980.

All students took a pre-test and an identical post-test as a measure of their capability of adequate usage of library resources. Participating students were required to complete the workbook assignments as a part of their coursework. Assignment sheets submitted which contained incorrect answers were to be returned to the student for repetition of the assignments until done correctly.

III. ELEMENTS OF FEASIBILITY STUDY

A. Phase I - May 11- June 30, 1981
Material Development

The workbook has a chapter format with the initial 13 chapters covering the basic categories of research materials applicable to the sciences. Chapters typically consist of a brief, but comprehensive, introduction of the specific resource (or type of resource) available. Five different versions of the workbook were developed to reduce the possibility of copying answers. Following the basic 13 chapters, the workbooks used by each of the three participating departments have indices and abstracts to periodical literature tailored to the specific discipline of the department. Some indices overlap for the three departments, while others appear only in one version.

The material development phase provided modified lessons.

1. The following areas were revised:

   A) The library tour assignment was changed to multiple choice format.

   B) Typing errors identified in the first edition were corrected.

   C) Changes were made in chapters and assignments as identified from the Pilot Study - Fall 1980.

2. Modified chapters and assignment variations were developed to include bioengineering examples:

   A) Chapter 5 and Assignment 5 (Locating Books)

   B) Chapter 6 and Assignment 6 (Classification Systems)

3. New chapters and 5 variations for each corresponding assignment were developed. By department request, the following new chapters for specific indices and abstracts were developed:

Ag & Bio Engineering	Entomology	Biological Sciences
A) VSMF	A) Entomology Abstracts	A) Chemical Abstracts
B) Engineering Index	B) Review of Applied Entomology	B) Zoological Record
C) Index Medicus	C) Index Kewensis	C) Index Kewensis
	D) Zoological Record	D) Index Medicus
	E) Chemical Abstracts	

4. A descriptive chapter about CAIRS and the use of computerized literature search as a research tool was developed.

5. A one-page answer grid was developed to allow transfer of answers from the individual assignment pages to decrease correction time by use of a hand grid.

6. Pre-tests (and Post-tests) were modified to reflect the contents of the workbooks by department.

B. Phase II - July - August, 1981
Material Reproduction

1. Printing

Material reproduction included the following activities:

A) Materials developed were typed into a word processor to create printing masters. Individual assignment variations were typed into these printing masters to create 130 assignments sheets.

B) Five complete workbooks were assembled reflecting the variations developed. Each variation was tested to identify errors either in typing or in content. (See Appendix for Table of Contents for the 4 workbooks).

C) Errors identified in the trial runs were corrected on the printing masters.

D) Answer grids were developed for each workbook.

E) The workbooks were printed in 4 stages: (1) versions adapted for Agricultural and Biological Engineering, (2) versions adapted for the Department of Biological Sciences, (3) versions adapted for Entomology and (4) one complete workbook with all chapter and assignment variations. These were printed with 5 different variations for each department workbook. Workbooks were color-coded by subject: buff covers and assignment sheets for Ag & Bioengineering; green covers and assignment sheets for Biology; and blue covers and assignment sheets for Entomology. Twenty copies of five variations were printed for Ag & Bioengineering. Both Biology and Entomology workbooks had ten copies of five variations each. Master assignment grids were developed to match the variations and color-coded by discipline.

F) Covers and fasteners were placed on the workbooks.

G) Pre-tests (same post-test) were developed to match the specific discipline. Computer answer grids were provided by the Institute of Research for use both in the pre-test and the post-test analysis of the material and skills attained by students.

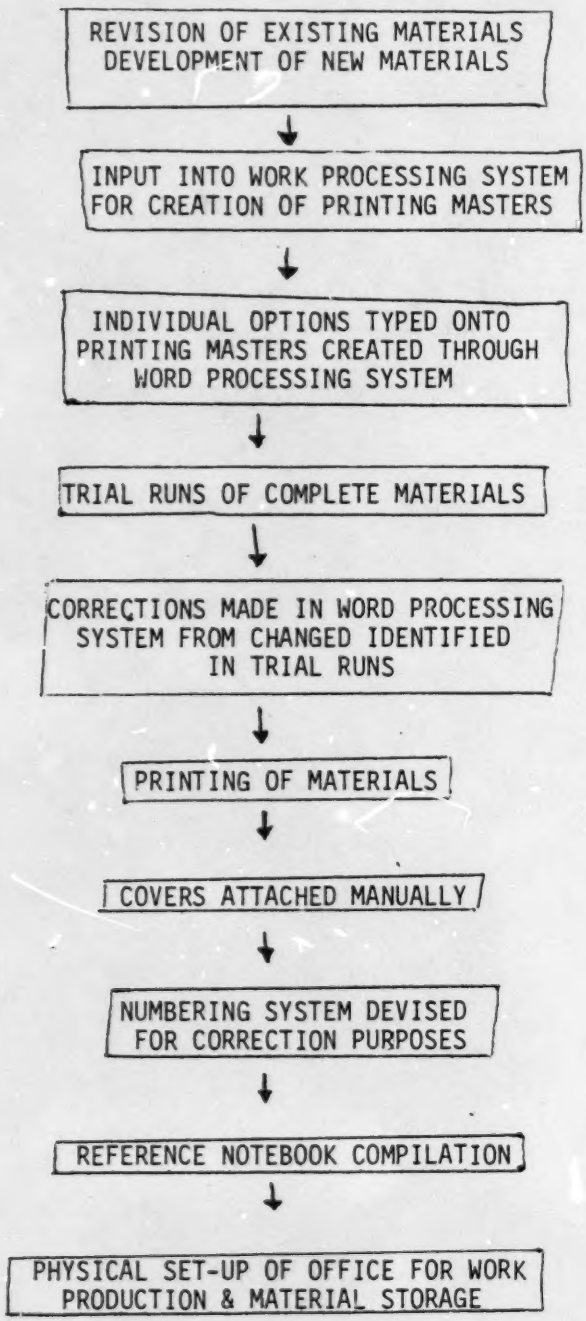
H) Workbooks were numbered and a system set up for identification of the master answer grid to use in correction of the twenty workbook variations created.

I) A reference notebook was developed including (a) all chapters and assignment pages to note editing comments, (b) correction grids for each variation (20 total), and (c) master assignment sheets with the answers and questions on them.

J) A filing system was created for organizing the printing masters, master assignment sheets, procedures established, and forms used in the development of the materials.

For convenience, a flow chart is given for these activities on the following page.

Work Flow for Material Development


REVISION OF EXISTING MATERIALS
DEVELOPMENT OF NEW MATERIALS
INPUT INTO WORK PROCESSING SYSTEM FOR CREATION OF PRINTING MASTERS
INDIVIDUAL OPTIONS TYPED ONTO PRINTING MASTERS CREATED THROUGH WORD PROCESSING SYSTEM
TRIAL RUNS OF COMPLETE MATERIALS
CORRECTIONS MADE IN WORD PROCESSING SYSTEM FROM CHANGED IDENTIFIED IN TRIAL RUNS
PRINTING OF MATERIALS
COVERS ATTACHED MANUALLY
NUMBERING SYSTEM DEVISED FOR CORRECTION PURPOSES
REFERENCE NOTEBOOK COMPILATION
PHYSICAL SET-UP OF OFFICE FOR WORK PRODUCTION & MATERIAL STORAGE

C. Phase III - September 1 - December, 1981
Program Implementation

1. Experimental Design

The Feasibility Study was done with participants from 3 departments: Agricultural and Biological Engineering, Department of Biological Sciences, and Department of Entomology. Students participating were (a) students at the undergraduate level and (b) students at the graduate level.

Two groups of undergraduate students completed the workbook as a required part of the course (Honors Zoology class and an Introductory course in the Ag & Bioengineering Department). Graduate students participated and completed the workbook also as a part of a course in Entomology.

Students in a large botany class were divided into two groups. A small number volunteered to use the workbook. The remaining students (87) were used as a control group: they did not use the workbook. All groups (with the exception of the botany volunteers referred to above) were required to complete the workbook assignments as a part of their course. The control group had no exposure to the workbook. All participants were given a pre-test and a post-test consisting of selected questions from the workbook. At the end of the study, the effectiveness was quantified by the statistical analysis of the mean pre-test and post-test scores.

2. Timetables for Completion of Assignments

All groups met in the library for administration of the pre-test and assignment of the individual workbooks. Students were given two weeks in each group to complete the workbook. Completion of the workbooks followed a scheduling plan to have different groups completing the workbook at different times to lessen anticipated demands the groups could place on staff and resources in the PB.

All groups returned to the library to take the post-test. Assignment pages were removed from the workbooks and stapled behind the master answer grid.

IV. RESULTS OF FEASIBILITY STUDY

A. Effectiveness of the Workbook

Results of the study are shown in Table 1 and Figure 1. For those students who did not use the workbook, the mean post-test score is significantly higher, at the 0.05 level, than the mean pre-test score. Note that the difference of these means is only barely significant. This result implies that the act of taking the pre-test, in and of itself, predisposes students to a better post-test performance. Although this hypothesis is not verified by the results, it is certainly reasonable. The important result is shown in Figure 1. Students who used the workbook scored significantly higher on the post-test than on the pre-test (see Table 1). This mean score difference is highly significant at the 0.05 level. This post-test score gain cannot be explained simply by the fact that the pre-test predisposes students to a better performance on the post-test. We believe that it is clear that there is a significant increase in the score on a standard test and we assert that the difference is due to use of the library skills workbook. Individual scores on pre-tests, post-tests, and workbooks for all students are given in Appendix.

B. Performance on the Workbook

Performance of students by specific subject and discipline variation are presented in Table 2. The scores reflect the initial completion of the materials. Most students completed the materials with very few errors. The graduate students in Entomology, Honors Zoology students, and volunteers completed the materials with the fewest incorrect answers.

An analysis of the specific questions missed revealed the following reasons for incorrect answers: 1) the answer was left blank, 2) there was an error in the materials, but the student did not seek assistance. Further analysis of the specific questions missed revealed that errors were due to 1) missing pages in the materials, 2) typographical errors, and 3) specific difficult question options. Many of the students that missed 11 or more questions did not complete the index and abstract sections, the more sophisticated and discipline-oriented sections of the materials. This analysis provides us with information for changes to improve the materials and also identifies those students who need additional assistance in learing how to use the library. It is difficult to know why these students have problems, but further contact could be provided to assist them with their specific problems.

An analysis of the specific questions missed by workbook variation is presented in Table 3. From this analysis, we find that one version does not appear to be more difficult than another. The specific editing needs were identified in the editing copy of the materials.

Table 1. T - test for significance of difference between means of pre-test and post-test scores of students who did and did not use the workbook.

Group	N	t	d.f.	Critical value of t at 0.05	Significant at 0.05
With workbook	68	-15.86	67	1.997	yes
Without workbook	87	-2.00	86	1.988	yes (barely)

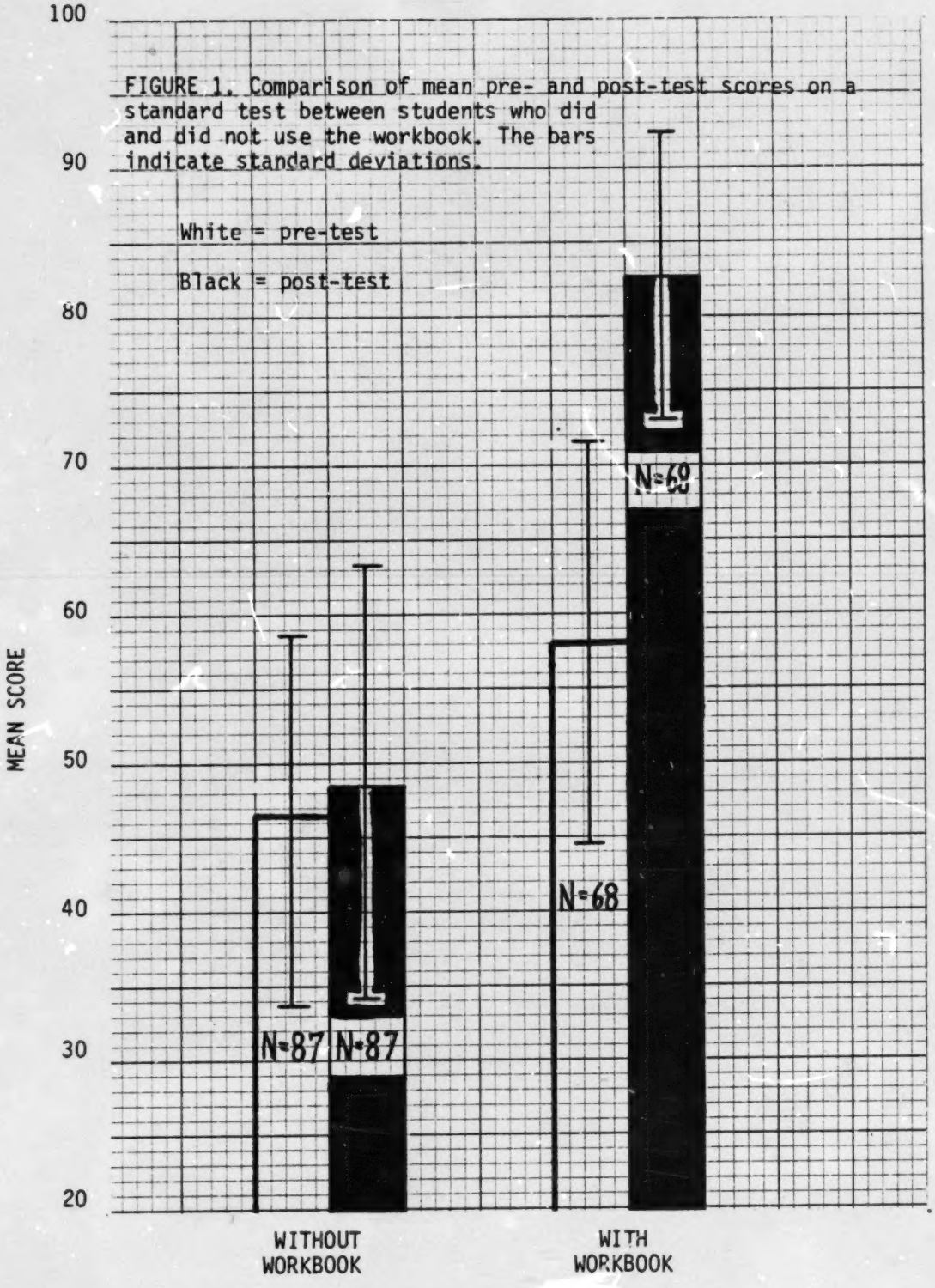


FIGURE 1. Comparison of mean pre- and post-test scores on a standard test between students who did and did not use the workbook. The bars indicate standard deviations.

Table 2. Scores on Workbook Exercises

Group: Agricultural and Biological Engineering Students

Total Questions: 78
Number of Students Completing Workbook: 50

SCORES	NUMBER MISSED	NUMBER OF STUDENTS WITH THIS SCORE
100% (78/78)	0	5
98% (77/78)	1	2
97% (76/78)	2	6
96% (75/78)	3	3
95% (74/78)	4	4
94% (73/78)	5	4
92% (72/78)	6	6
91% (71/78)	7	5
89% (70/78)	8	4
85% (67/78)	11	2
78% (61/78)	17	2
	Over 17	7

Group: Entomology Students

Total Questions: 81
Number of Students Completing Workbook: 14

SCORES	NUMBER MISSED	NUMBER OF STUDENTS WITH THIS SCORE
100% (81/81)	0	6
99% (80/81)	1	4
98% (79/81)	2	2
96% (78/81)	3	2

Group: Honors Zoology Students

Total Questions: 80
Number of Students Completing Workbook: 6

SCORES	NUMBER MISSED	NUMBER OF STUDENTS WITH THIS SCORE
99% (79/80)	1	1
96% (78/80)	2	1
95% (76/80)	4	1
93% (74/80)	6	1
91% (73/80)	7	1
86% (69/80)	11	1

Group: Botany Volunteers

Total Questions: 80
Number of Students Completing Workbook: 9

SCORES	NUMBER MISSED	NUMBER OF STUDENTS WITH THIS SCORE
100% (80/80)	0	4
99% (79/80)	1	2
96% (78/80)	2	1
95% (76/80)	4	2

Table 3. Analysis of Workbook

Agricultural and Biological Engineering Variations

NUMBER MISSED	TOTAL Ver. 1	TOTAL Ver. 2	TOTAL Ver. 3	TOTAL Ver. 4	TOTAL Ver. 5
0				4	1
1	2				
2		2	1	2	1
3	1	2			
4	2		1	1	
5	1		2	1	
6	2		2	2	
7			1	1	3
8		1		1	2
11		2			
17	1		1		
Over 17	2	2	1		2

Biological Sciences Variations: (volunteers and Honors Zoology students)

NUMBER MISSED	TOTAL Ver. 1	TOTAL Ver. 2	TOTAL Ver. 3	TOTAL Ver. 4	TOTAL Ver. 5
0		1			1
1				2	1
2			1	2	1
4	1	1	1		
6					1
7		1			
11				1	

Entomology Variations

NUMBER MISSED	TOTAL Ver. 1	TOTAL Ver. 2	TOTAL Ver. 3	TOTAL Ver. 4	TOTAL Ver. 5
0	2		2	1	1
1		1	1	2	
2		1			1
3	1	1			

V. DISCUSSION

A. Effectiveness of the Workbook

Results of the feasibility study demonstrate a significant beneficial effect from use of the workbook for library instruction in the sciences as measured by increases in scores on a standard test. Every group of students who either volunteered or were required to complete the assignments had statistically greater score increases on the standard test than did those groups of students to whom the workbook was not available. We conclude that Science Resources: A Self-Paced Instructional Workbook, as used in this study greatly improved students' ability to use library resources.

B. Materials

1) Content

The content of the workbook was expanded to meet the needs of students at these levels in science courses at MSU: 1) undergraduate students in the Agricultural and Biological Engineering program, 2) undergraduate and graduate students in the Department of Biological Sciences, and 3) graduate and undergraduate students in the Department of Entomology. All groups completed a core section of chapters and assignments covering basic tools required for general research activities in the sciences. Specific instruction by subject area and discipline was provided in the index and abstract chapters.

The format is flexible, allowing: 1) the choice of materials to meet specific course requirements, 2) instruction in library skills based on the scientific field of study, and 3) adaptation to either basic skills or more advanced skills for graduate level students. The materials presently are developed for small groups. If the materials were expanded, they could be used with larger groups in the biological sciences. Additional question variations would be needed to avoid student collaboration in groups of more than 60 students.

Additional chapters and assignments could be developed for materials not in the workbook presently, such as Energy Research Abstracts, Nutrition Abstracts or any of the many indexes in the sciences. Faculty members need to cooperate with the library in determining the specific instructional requirements and in determining which reference tools would be the most appropriate. A descriptive chapter was included in the workbook about the use of the computerized literature search as a research tool. Assignments could be developed to provide an actual experience using this service provided funds were available to cover the costs incurred for the searches performed.

Machine-readable answer forms, provided by the Office of Institutional Research, MSU, were used for the pre-tests and post-tests. Correction and analysis of scores were also provided by this office. We suggest using this method of evaluation with any future use of the materials to determine whether the students continue to improve by their use.

2) Material Production

Use of a word processor to record materials on tape decreased the typing and editing time required to prepare the present subject-oriented variations of the workbook. Individual question options, however, were typed onto the masters. Illustrations and maps were prepared manually and transferred to the masters created on the work processing system.

Materials were printed using an IBM copy machine that 1) printed on both sides of the paper, decreasing the number of pages per book, and 2) was equipped with a 20-bin collating attachment, eliminating the manual collation of the chapters and assignment pages. Covers were placed on the materials manually by use of Acco fasteners.

C. Timetables for Completion of Assignments

Each group participating had a different starting and completion date, so that the numbers of students in the study did not greatly impact on staff in PB. Students did come for assistance when they needed it. We were pleased that the students felt comfortable coming to us and hope this positive relation will continue. All too many people hesitate to get assistance when they really need it. The majority of the students in the study, however, were able to complete the assignments in the 2-week period, by reading the descriptive chapters and then completing the assignments based on the specific tool.

Most students reported it required between 6-8 hours to complete the assignments. However, some of the foreign students did need more time and assistance from the reference staff. The workbook continues to be used in PB for training new staff and as a part of the ongoing training of student assistants in the department.

D. Correction of Assignments

Individual assignment pages were removed from the workbooks. The answers were then transferred to a one-page answer sheet. This sheet was stapled to the top of the assignment pages. This system was useful for keeping assignments together by student and also by group. Those students who needed to repeat incorrectly answered questions were readily identifiable from answer sheets returned as a complete set.

Hand grids with holes punched out corresponding to a specific workbook variation were developed. A numbering system was devised to readily identify the answer grid to use for correction of a specific workbook. Correction time was decreased from 15 minutes per workbook when individual assignment pages were corrected without such a grid, to approximately one minute with the grid.

E. Editing and Revision

An editing copy of the workbook was set up in a loose-leaf notebook. Changes and additions made in this copy constituted the final draft for descriptive chapters and the 20 assignment variations. Revisions and further updating will be done in the editing copy in order to ensure coordination and inclusion of materials orginating from several independent sources.

F. Cost and Staff

The costs of the feasibility study were shared by the Mitchell Memorial Library, the Agricultural and Biological Engineering Department, the Department of Biological Sciences, the Department of Entomology, the Office of Graduate Studies and Research, the Institute of Physical and Biological Sciences, and the Academic Excellence Fund, MSU. See Table 4 for Costs of the Entire Project. This funding provided for material reproduction and for additional staff to work with the project.

The major impact on the Physical and Biological Sciences Reading Room (PB) occurred in the form of staff time for support activities related to preparation of the workbook. Additional staffing partially compensated for the librarian's time directly involved with typing, support in development of new chapters and assignment variations, attaching of covers to workbooks and numbering system, correction of assignments, assistance of the analysis of the data from pre-test and post-test scores, and related record keeping. The additional staff assisted greatly in typing, of the final report and the compilation of scores on the materials plus in the analysis of the strengths and weaknesses of the materials. The librarian was responsible for supervising the staff, coordinating the workbook completion schedules as a normal part of the work schedule, developing new materials. Supervising the printing of the different variation was done outside official work hours with assistances from Drs. Wise and Ellsbury and the staff at OGSR.

Table 4. Costs of Feasibility Study (May-December, 1981)

	COSTS	TOTAL
MATERIAL PRODUCTION		
Printing Masters (328 @ 75¢/master)	$ 246.00	
Xeroxing (50,000 sheets @ 2½¢/sheet)	1,250.00	
Paper (55 reams @ $4/ream)	220.00	
Cover Expenses (printing, scoring, punching holes)	34.16	
Drilling Holes in Paper	48.00	
Acco Fasteners	58.00	
		$1,856.16
SALARIES		
Librarian:		
(May-August 150 hours to develop materials)	$1,134.00	
(September-December 72 hours to coordinate study)	554.00	
Total hours 222		$1,678.32
Student Assistant:		
(May-June 60 hours @ $3.35/hr)	$ 201.00	
150 hours @ $3.35/hr)	351.00	
(September-December 225 hours @ $3.35/hr)	753.75	
Total hours 390		$1,286.50
GRAND TOTAL OF COST		$4,820.98

VI. CONCLUSION

Any expansion of science-related library instruction should include a workbook as an integral part of academic courses. The students would be required to complete the workbook correctly to receive a grade in the course. Incorrect answers would be repeated.

To implement such a program, a two-phase plan is suggested:

PHASE I -

Allocation of Staff

1. Librarian: Authorization to devote predetermined % of official time coordinating the program and developing materials.
2. Provide support staff for typing, devising and proofing question variations, collation of materials and correction of assignments.
3. Operator for word processor to type materials and make revisions for final draft.

Materials

1. Development of additional question variations to avoid student collaboration based on the number of students to complete the workbook.
2. Development of new chapters not included in the materials in the present workbook.
3. Revision of existing materials.
4. Input of materials into a word processor.
5. Individual question options typed onto printing masters.
6. Trial runs of new question variations and chapters.
7. Preparation of final masters for printing.
8. Preparation of answer grid to correspond to each new variation created.

Workbook Production

1. Print workbooks.
2. Attach covers.
3. Print the pre-tests (same post-test) for new variations.
4. Collate the pre-tests (the same would then be used as post-tests).

PHASE II - Implementation of Program

Allocation of Staff

1. Librarian: Authorization to devote predetermined % of official time coordinating the program and supervising the staff.
2. Provide support staff for assignment correction, record keeping, revision of materials, typing.
3. Operator for word processor to update materials following completion of each testing cycle.

Program Design

1. Students purchase (or are provided) workbooks.
2. Administration of pre-tests to students.
3. Students complete the workbook assignments following a pre-determined schedule. Each group would have different starting and completion dates allowong 2 weeks for each group to complete the workbook.
4. Correction of assignments. Identification of students who need to repeat assignments.
5. Administration of post-test to students.
6. Correction of pre-tests and post-tests by Institutional Research.
7. Return scores to individual students (pre-test and post-test).

Evaluation and Planning

1. Comparison of pre-test and post-test scores to determine effectiveness of materials.
2. Determination of changes and revisions in materials.
3. Analysis of progress dynamics related to the demands on staff in PB and resources in the library used in the assignments.
4. Determination of costs to continue the program, including: library materials, supplies, staffing and production of workbook expenses.

Addition means to staff and fund an expanded program are essential, whether provided cooperatively between the library, the individual departments, through university funding, or by cost-recovery through an eventual self-supporting program involving sale of the workbooks.

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APPENDIX

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IV. INDEXES AND ABSTRACTS TO JOURNAL LITERATURE . . . 29

BAI Biological and Agricultural Index 1

BAG Bibliography of Agriculture 1

IM Index Medicus 1

EI Engineering Index 1

V VSMF. 1

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ZR Zoological Record 1

EA Entomology Abstracts. 1

RAE Review of Applied Entomology. 1

IK Index Kewensis. 1

IM Index Medicus. 1

EI Engineering Index. 1

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AG & BIOENGINEERING				
STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK SCORE Percentage/	number missed
1	54		91%	7
2	71			
3	36	79	92%	6
4	36	64		
5	54	86	95%	4
6	71	93	100%	0
7	68	71	19%	63
8	54	79	37%	49
9	61	82	98%	1
10	54	68		
11	50	93	95%	4
12	75	75	41%	46
13	61	75	94%	5
14	54	100	98%	1
15	54		78%	17
16	57			
17	61	68	92%	6
18	61	93	91%	7
19	61	96	100%	0
20	71	89	63%	29
21	57			
22	64	89	92%	6
23	43	79	70%	29
24	68	100	94%	3
25		89	92%	6
26		96	97%	2
27		93	91%	7
28	46	64	78%	17
29	57	79	85%	11
30	57	89	95%	4
31	68	82	92%	6
32	57		96%	3
33	61	89	97%	2
34	54	86	91%	7
35	32	86	100%	0
36	64		94%	3

ENTOMOLOGY				
STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK SCORE Percentage/	number missed
1	39	73	99%	1
2	42	70	96%	3
3	76	94	99%	1
4	82	94	100%	0
5	82	94	100%	0
6	61	79	98%	2
7	55		100%	0
8	70	85	99%	1
9	67	79	99%	1
10	70	88	100%	0
11	55	79	100%	0
12	58	85	100%	0
13	67	79	98%	2
14	30	70	100%	0

VOLUNTEERS

STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK SCORE Percentage/ number missed	
1	59%	81%	100%	0
2	53%	81%	96%	2
3	84%	88%	100%	0
THESE STUDENTS DID NOT DO THE WORKBOOK				
4.	84%	59%		
5	63%	78%		
6.	72%	78%		
7.	69%	66%		
8.	56%	31%		
9.	66%	72%		
10.		72%		
11.		88%		

HONORS - ZOOLOGY

STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK SCORE Percentage/	number missed
1	47%	72%	86%	11
2	53%	84%	93%	6
3	34%		91%	7
4	34%	78%	95%	4
5	53%	78%	96%	2
6	47%		99%	1

VOLUNTEERS BOTANY

STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK SCORE Percentage/	number missed
1		78%	100%	0
2	25%	69%	100%	0
3	59%	84%	99%	1
4	50%		99%	1
5	72%	81%	95%	4
6	59%	72%	95%	4

CONTROL GROUP -- SECTION 1 BOTANY

STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK NOT AVAILABLE
1	22%	28%	
2	53%	50%	
3	47%	41%	
4	53%	53%	
5	44%	53%	
6	50%	44%	
7	47%	44%	
8	63%	72%	
9	41%	19%	
10	44%	19%	
11	56%	47%	
12	63%	78%	
13	16%	22%	
14	53%	56%	
15	50%	50%	
16	63%	59%	
17	53%	69%	
18	44%	44%	
19	41%	47%	
20	53%	63%	
21	47%	56%	
22	63%	63%	
23	56%	22%	
24	66%	56%	
25	59%	59%	
26	38%	50%	
27	38%	56%	
28	41%	44%	
29	31%	28%	
30	28%	41%	
31	50%	59%	
32	47%	38%	
33	44%	28%	
34	56%	56%	
35	31%	34%	
36	47%	59%	

CONTROL GROUP -- SECTION 1 Botany

STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK NOT AVAILABLE
37	53%	59%	
38	41%	56%	
39	47%	44%	
40	41%	63%	
41	53%	66%	
42	53%	56%	
43	44%	28%	
44	53%	31%	
45	22%	41%	
46	31%	22%	
47	19%	34%	
48	41%	41%	
49	31%	44%	

CONTROL GROUP -- Section 2 BOTANY			
STUDENT	PRETEST SCORE	POSTTEST SCORE	WORKBOOK NOT AVAILABLE
1	50%	31%	
2	63%	63%	
3	53%	63%	
4	41%	53%	
5	63%	78%	
6	28%	50%	
7	50%	47%	
8	50%	47%	
9	53%	50%	
10	47%	34%	
11	63%	69%	
12	56%	50%	
13	38%	41%	
14	47%	31%	
15	38%	50%	
16	38%	56%	
17	66%	59%	
18	44%	50%	
19	50%	53%	
20	56%	75%	
21	38%	31%	
22	50%	53%	
23	44%	53%	
24	47%	59%	
25	56%	53%	
26	41%	50%	
27	63%	63%	
28	9%	19%	
29	41%	47%	
30	41%	59%	
31	41%	53%	
32	44%	59%	
33	19%	28%	
34	25%	16%	
35	63%	59%	
36	63%	66%	
37	53%	56%	
38	63%	66%	